universal, and where they will make the distribution of electricity for lighting on a large scale better able to compete in price with gas.

THE MAGNETIZATION OF WATCHES. — With the rapid introduction of dynamo-electric machines and electric motors, there has arisen an inconvenience that is not only felt by those who work in electric-lighting stations, but which is likely to affect the public generally. Steel is usually used in the quick-moving parts of watches; and when this, for any reason, gets in a strong magnetic field, it becomes magnetized, greatly changing the rate of the watch, and making it irregular. It is possible to demagnetize a watch that is affected in this way; but it is a troublesome process, and is not a permanent safeguard. To avoid this trouble, non-magnetic balances are being rapidly introduced; and, although those made at present are more costly than steel, yet they add but little to the total cost of the watch, and make it reliable under all conditions. Probably the first to make an alloy that would possess the properties of hardness and elasticity without being magnetic, was Paillard. He has described several alloys that may be used; and watches made with balance-wheels and hair springs of these alloys have stood the most severe tests, with success. The most important component in the alloys is palladium. The other components are copper and iron, for one of the alloys; viz.: —

Palladium	50 to 75 parts
Copper	20 " 30 "
Iron	5 " 20 "

Another alloy is, —

Palladium	65 to 75 parts
Copper	15 " 25 "
Nickel	1 " 5 "
Gold	1 " 2½ "
Platinum	½ " 2 "
Silver	2 " 10 "
Steel	1 " 5 "

These alloys, especially the latter, are almost free from magnetic properties. Balances that are to be compensated for temperature are either made of two segments of alloys of different compositions, having different rates of expansion; or the segments are one of alloy, the other of silver. Since attention has been called to Paillard's methods, quite a number of manufacturers in this country and England have experimented on the subject, and are now making non-magnetic watches; and it is probable that at an early day the majority of the watches sold will be made to resist the action of magnetic fields.

CONDUCTIVITY OF A VACUUM. — M. Foeppl has experimented on the conductivity of a vacuum by an ingenious method. He made an induction-coil whose secondary circuit consisted of a glass tube 7 millimetres external diameter, 4.2 millimetres internal diameter. The ends of this coil were connected to a second coil so arranged as to form a galvanometer, within which was a magnet suspended by a cocoon-fibre. The glass tube forming the secondary circuit was coiled in two layers of 18 turns: the primary coil was 24 centimetres long, and was composed of twelve layers of seventy-two turns of wire. With a current of 22 ampères in the primary, making and breaking the circuit, M. Foeppl could not discover any deflection of the needle when there was a vacuum in the secondary tube, even when the degree of rarefaction was changed through a somewhat wide range. He calculates from his experiments that the resistance of such vacuums as he used could not be less than 3×10^6 times that of pure copper. This experiment bears directly on the question as to whether a perfect vacuum would be a perfect conductor or a perfect insulator, since the effect of the electrodes used to introduce the current into vacuum tubes is avoided. While it has, to within a short time, been admitted that a tube in which there is a very perfect vacuum will not admit the passage of electricity, it has been held by some that the result is due to an enormous resistance at the surface of the electrodes, not in the vacuum itself. This experiment disproves this view; at least, for the degrees of rarefaction employed. The wonderful influence of light on electric discharges that is being now investigated by so many experimenters would possibly have influenced the results of M. Foeppl's experiments, if they had been tried in the presence of some intense source of light.

WINDMILLS FOR ELECTRIC-LIGHTING. — Some time ago the possibilities of windmills for domestic electric-lighting were mentioned in this journal, and lately the experiment has been practically tried. Professor Blyth read before the Glasgow Philosophical Society a paper on the subject, in which he describes an experiment which he made last summer, — the lighting of a cottage in which he spent his vacation by a dynamo driven by a windmill, and charging a storage-battery. The windmill used was an old-fashioned type, with four arms at right angles to each other, each of them thirteen feet long. There was no especial regulating-device. The dynamo was belted directly to the fly-wheel of the mill, and charged twelve cells of storage-battery which supplied the incandescent lamps in the cottage. Professor Blyth had never used more than ten lamps at once, but he could have used more. With a good breeze, enough electricity could be stored in half a day to supply light for four evenings of three or four hours each. The lamps used were of 8-candle power. When charging, the current passed through a cut-out that would disconnect them from the dynamo when it ran below a certain speed: so the windmill could be allowed to run all the time, charging the battery when the wind happened to be strong enough. The current had been used to run a light turning-lathe, and Professor Blyth had begun to make a light carriage to be run by the stored electricity. The paper opens to us a field for ingenuity, comfort, and amusement in our homes. Windmills much superior to that described can be readily purchased, a small dynamo can be bought or built at little cost, and storage-batteries can be purchased or made. With them we could light our house economically; our light would be better, cooler, and healthier than gas or coal-oil lamps; while the current could be utilized for running fans, sewing-machines, etc. Indeed, to the average American, with some spare time and some small ingenuity, the amusement and instruction of such a plant would more than pay for its expense.

HEALTH MATTERS.

Cremation of Garbage.

THE important subject of garbage-cremation, and the recent advances made in this method of disposing of this waste material, are admirably summed up in the following extract from the *Sanitary News*: —

An indorsement of the method of disposing of kitchen waste, recently inaugurated in Chicago, was pronounced before the section on State medicine at the Cincinnati meeting of the American Medical Association, Tuesday, May 8, by Dr. J. Berrien Lindsley of Nashville, Tenn. Dr. Lindsley's paper was an exhaustive *résumé* of the present status of garbage-cremation. He gave two or three examples showing the great quantity and variety of polluting material occurring without pause in the limits of a city.

Baltimore, August, 1887, estimated by police census, had a population of 437,155. The amount of night-soil delivered at the dumps for the year ending Dec. 31, 1887, was 51,107 loads, or 10,221,400 gallons. Probably more than half the inhabitants use water-closets which carry off an equal amount.

The dead animals, etc., removed during the same year, were: —

Total number of dead animals	25,249
" " " fowls	9,079
" " " fish	23,574
" " cart-loads of dead fish, vegetable and other offal removed from various docks	1,067
" " pounds of decayed meat condemned	1,495
" " dozens of eggs condemned	607

Richmond, population 100,000. The report of contractor for removal of garbage or kitchen refuse, year 1887, shows total number of loads carried off 2,680, equal to 72,200 bushels.

Memphis, population 62,335. Number of loads of garbage removed in 1887 was 29,120.

These examples were selected at random. To keep the city clean is the principal work of municipal governments, and requires more expenditure of money than all other objects combined, excepting schools and police.

The city filth naturally falls into four main subdivisions, — street-sweepings, night-soil, dead animals, and garbage. The latter alone concerns us at present. The definition of garbage is refuse

animal and vegetable matter from the kitchen. Every household is a workshop for garbage. In the country and small towns many a family is poisoned by the careless accumulation of the same near the well or sleeping-apartment. In small towns it is mostly got rid of by feeding to swine and cows; in larger communities, by carting off and polluting harbors or rivers.

In the second report of the State Board of Health of Maine, 1887, the secretary, Dr. A. G. Young, says, "Of the several methods which have hitherto been in use (for removing garbage), it may be said that none of them are free from serious objections. If the garbage is carried any considerable distance into the country, its transportation is attended with considerable cost. If buried, it still often remains a nuisance by contaminating the air or polluting the water in the neighborhood. If utilized in part as food for swine or cows, there is sometimes inflicted upon the community which sends it forth a retributive penalty in the shape of an unwholesome milk and meat supply.

"In the case of a seaboard town, if it is sent seaward, the garbage may depart from the place of its origin never to return, but in large part it is strewn along other coasts.

"The great desideratum has seemed to be some method which would not require a costly transportation of the garbage, or necessitate the defilement of our seashores, but which would radically and ultimately destroy it near the place where it is produced.

"Within the last few years, a new method of disposing of garbage has been written about and talked about, and to a considerable extent put into operation and practically tested. It is the method of destroying or cremating garbage by means of furnaces specially constructed for that purpose. Where these garbage-furnaces have been put into use, there is pretty uniform consensus of testimony as to their success. When rightly built, they have done their work satisfactorily, and generally at considerably less expense than had hitherto been incurred in disposing of the garbage otherwise. But little or no cost is incurred for fuel to run the furnace, as the garbage is dried more or less before it is burned, and is made to consume itself. The cost of labor in attending the furnace is not great, and generally there are no unpleasant odors given off in the process of burning.

"This method has not been much used in this country, but in Europe, and particularly in England, it has been extensively employed. Dr. O. A. Horr, a member of this board, who has lately returned from Europe, made special inquiry in regard to garbage-cremation in England, and all he could learn convinced him that this system is a success in that country. The garbage-furnaces in many of their towns have been in operation many years, and, in conversation with the health-officer of the city of London, he learned that there are now forty-five of the English towns which make use of this garbage-destruction.

"In this country, so far as I know, the experiment of destroying garbage by means of a furnace constructed specially for that purpose was first tried on Governor's Island, New York harbor. A description of this garbage-cremator was given in the *Sanitary Engineer* of Aug. 13, 1885, by Lieutenant Reilly, at this time acting assistant quartermaster, U. S. A., at that post." This description is reproduced in the report above quoted.

In the twelfth volume of 'Public Health,' containing the reports and papers presented to the American Public Health Association, at the Toronto meeting, October, 1886, may be found a paper by Dr. George Baird of Wheeling, giving an account not only of the destruction of garbage, but also of night-soil, by means of a furnace contrived by M. V. Smith, M.E., Bissell's Block, Pittsburgh, Penn. Dr. Baird is brief, and has "only tried to furnish proof of its capacity to solve a long-tried problem in the government of our cities and large towns."

The city authorities of Wheeling were stimulated to action by those of Bellaire, O., on the opposite side of the river, but in close proximity. The dumping of night-soil and garbage from Wheeling into the Ohio River had become an intolerable nuisance to the inhabitants of Bellaire living just below. No alternative remained but to abate the nuisance. A similar alternative will soon be forced upon many of our riparian cities and towns. Law will decide that rivers do not belong to those who happen to dwell near the source, but equally to all below, and that the upper few have no right to deposit their filth in floating columns upon the lower many.

In the 'Report on the Sanitary State of Montreal for the Year 1886,' will be found an interesting narrative in this connection, giving instructive details as to cost, showing the extent of the work to be done and the complete success of the refuse-crematories, and also of the night-soil crematories. It thus appears that Wheeling and Montreal are the pioneer cities in arousing public attention to the cremation of garbage and night-soil.

Dr. Lindsley then sketches the later developments in the new method of destruction and sanitation by fire.

"Other cities," he says, "are taking hold of the experiment with much enthusiasm. *The Sanitary News* of Nov. 19, 1887, states that at Des Moines, Io., a small Engle furnace is in experimental use, and is working very satisfactorily. At Pittsburgh a Rider furnace had just commenced its service. In Chicago a Mann furnace was being constructed.

"In the same valuable journal, March 17, 1888, may be found a full description of the Chicago garbage-crematory, from which a duplicate of the plant could be built if desired.

"On April 14 it reports that the said crematory is doing good service in disposing of about fifty tons of material a day. *The Sanitary News* of March 10, 1888, reports the success of the disposal of garbage by cremation at Milwaukee.

"All who are concerned in this important subject will look forward with great interest to a paper on cremation, to be read at the Milwaukee meeting of the American Public Health Association in November next by Oscar C. De Wolf, M.D., the eminent health-commissioner of Chicago.

"We have seen how very recent is the resort to cremation for getting rid of garbage and other refuse in America, and it may with truth be claimed that Mr. J. M. Keating of Memphis, familiar with epidemics, first set this ball in motion. At the Indianapolis meeting of the American Public Health Association, October, 1882, he presented a paper on 'The Cremation of Excreta and Household Refuse.' He closes the paper thus: 'There is no real safety save by cremation. Yankee ingenuity, once directed in this channel, will doubtless be equal to the emergency, and provide just the kind of cheap furnace or stove necessary for the purpose. By this means, and this alone, can the ultimate of sanitation be realized.'

"Already, in 1879, Mr. Keating had presented his views on this subject through the New York *Herald*, and with the indorsement of that influential paper. In the American Public Health Association, however, he had a deeply interested auditory of experts, and his views attracted much attention. He was induced by many of its active members to prepare an elaborate paper for its meeting at St. Louis, October, 1884, which was published under the title, 'The Ultimate of Sanitation by Fire.' This is probably the most complete and thorough monograph on the subject in the English language. It was widely circulated in the volumes of the American Public Health Association and other channels.

"Individually, I subscribe to the principles and practical conclusions maintained and explained by Mr. Keating, and feel quite confident that in a few years Yankee inventive ingenuity will provide in great perfection the apparatus necessary for daily and cheap use.

"On this occasion I have confined myself to the cremation of garbage, because I am convinced that it will speedily come into use throughout America with like rapidity as has electric-lighting, and will pave the way for a wider and more perfect application of sanitation by fire."

Milk.

Dr. Parkes writes to the *British Medical Journal* as follows: "Whilst not denying that the tubercular virus may find other means of reaching the digestive tract than through unboiled cow's milk, it appears to me that there are no sufficient safeguards in the management of town dairies to warrant us in assuming that milk from cows in an advanced stage of tuberculosis has no chance of being mixed with the milk of other healthy cows. In every dairy of any size there will probably be tubercular cows, some of them, perhaps, with tubercular deposits in the udders; and, as it is the common custom with dairymen to mix together the milk yielded by different cows, it is not too much to assume that tubercle bacilli

may be widely distributed in the milk-supply of any town. It has been said that the tuberculosis of cattle is not the same disease as the tuberculosis of man, and that the absence of any proof of the human variety having ever been dependent upon ingestion or inoculation of the virus of the bovine variety tends to strengthen such a belief. To this it may be replied, that the bacilli of bovine tuberculosis are identical — according to all bacteriological methods at present known — with those found in tubercular formations in the organs of man, and that, although the disease presents anatomical differences in man and cattle, these differences may be explained as being due to differences of soil in the human and bovine tissues, the bacilli ingrafting themselves in those tissues which present conditions most favorable to their growth and development; second, absence of proof may only mean want of observation or recorded data, and cannot be held to imply that at no future time will satisfactory evidence of the dependence of the human disease upon a bovine source be brought to light.

"Having regard to all those considerations, surely the time has arrived when a radical change in the present methods of milk-production and milk-consumption is urgently needed. In the first place, it should be rendered illegal for cows known to be suffering from tuberculosis to be kept in stock by dairymen and farmers for milking purposes; and, second, in no household should unboiled milk be consumed, more especially by children. No other animal food is consumed by civilized nations in an uncooked state; and by the light of our recently acquired knowledge it would appear that there is as much, or more, danger connected with the practice of drinking unboiled milk as of eating raw flesh.

"Exposure to the heat of boiling water for five minutes destroys the life and action of the tubercular virus (Klein); and the same is true of the other specific disease-poisons. By such simple means, then, is it possible to guard against an ever-present source of danger, as well as to obtain protection from those possibilities of the introduction into our bodies of the viruses of enteric-fever, scarlet-fever, and the like, which the experience of past epidemics has taught us to be latent possibilities in milk, with powers of development at the most unexpected periods. If medical practitioners generally recognized the importance of these views, and were careful to enforce them upon those intrusted with the care of delicate children of scrofulous diathesis, or with hereditary tendencies to tubercle, a commencement would be made in the right direction, which would gradually extend itself through all classes of society."

ACTION OF BOILING WATER ON TYPHOID BACILLI. — Wilchur of St. Petersburg has found that when a volume of boiling water equal to that of a gelatine culture of typhoid bacilli is used on the culture, the bacilli are only partly destroyed; and that when the volume of water is double that of the culture, all the bacilli are killed. Experiments on the dejecta of typhoid patients showed that when four times the volume of water was added to the dejecta, the bacilli were invariably destroyed.

DEATHS FROM POISON. — There were in Great Britain, in 1886, 511 deaths from poison, including cases of chronic poisoning by lead. Of these, 327 were accidental, 178 suicidal, and only 6 homicidal. Lead heads the list of agents giving rise to accidental poisoning (95 cases); then follow opium and its derivatives (82 cases); carbolic acid (20 cases); belladonna is responsible for 9 cases; alcohol for 7; aconite, chlorodyne, and hydrochloric acid, each for 6; prussic acid, ammonia, and strychnine, each for 5. Carbolic acid was selected by 42 suicides; opium, laudanum, or morphine, by 41; oxalic acid, by 28; prussic acid, by 25; vermin-killer, by 18; hydrochloric acid, by 15; strychnine, by 14; sulphuric acid and arsenic have lost their popularity, the former having been used only by six and the latter by five persons.

DEATH IN BLIZZARDS DUE TO ASPHYXIA. — Markham writes to the *Journal of the American Medical Association* of Feb. 18, 1888, stating that there is an amount of evidence and a combination of circumstances sufficient to show that the greater number of the several hundreds who lost their lives in the recent great blizzard of the North-west perished from asphyxia, and not by freezing. Many of the bodies, when found, were in the position of grasping or clutching at their necks or throats. Indoor witnesses describe the atmosphere as having an appearance of density and darkness, similar to that stated by divers as existing when submerged with their armor in deep water. Many that escaped describe their peril as being from loss of breath or suffocation.

CROTON WATER. — At a recent meeting of the Medical Society of the County of New York, Dr. John C. Peters read a paper on 'The Water-Supply from the Croton Lake System,' in which he stated that the sewage created by 25,000 people, the largest condensed-milk factory in the world, 10,000 cows, 1,200 horses, 1,500 hogs, and 40 factories, was all being run into that body of water from which the city of New York draws its water-supply. While in former years the Thames water used by London contained five times as much bacteria as Croton water, recent investigations showed that in one cubic centimetre New York water contained 526 bacteria, against 44 contained by London water. While, of course, the greater part of these were the common, harmless bacteria, still there was a large proportion capable of producing disease; and he expressed the opinion that a great deal of the scarlet-fever, diphtheria, and other infectious diseases which prevailed in New York, might be traceable to germs derived from the water-supply.

HAIR-WASHES. — We learn from the *American Analyst* that recent analyses have shown, that of the preparations for bleaching the hair to "the delicate golden shade so much admired by the court circles of Europe, and the best society of the United States," to quote from a label on one of the bottles, all depend for their action upon the decolorizing and corrosive influence of nascent oxygen or nascent chlorine. The bases used in the various nostrums for this purpose are peroxide of hydrogen, aqua regia, and bronzer's acid. Peroxide of hydrogen is the mildest and most innocuous of the trio named. It is a colorless liquid which destroys the natural color of the hair, and which, if used long enough, turns it an unnatural grayish-white. It is rather expensive, and is therefore used much less than the two other acids. It produces sores upon the scalp, and gives rise to skin-complaints that resemble tetter, salt-rheum, and scald-head. The two acids are equally vile. They attack and eat the hair and skin alike. The former they partly bleach, and partly burn to a handsome gold color; the latter they stain to about the same hue as does a light application of iodine. Besides the dermatologic troubles named, they cause maladies hardly distinguishable from eczema and erythema. One curious disease that they cause is an inflammation of the cells of the hair follicles. The cellular walls break down, and lymph, and often blood, is extravasated in appreciable quantities. All three bases produce falling-out of the hair and premature baldness.

BOOK-REVIEWS.

The Social Influence of Christianity. By DAVID J. HILL. Boston, Silver, Burdett, & Co. 12°. $1.25.

THIS volume consists of a series of lectures delivered at the Newton Theological Institution, and designed partly to show what Christianity has done for society in the past, but more particularly to indicate its attitude toward the problems of the present. The treatment of such themes in lectures is attended with serious drawbacks, as it tempts the speaker to be what is called eloquent rather than thoughtful or clear; and this tendency is plainly visible in Dr. Hill's work.

The second chapter, on what Christianity has done for society, is a perfect dithyramb; and though it may have been well liked where it was originally delivered, yet when read in a quiet hour its turgid style and exaggerated statements produce an effect quite different from what the author intended. He seems to think that the higher civilization, which is well known to be of Greek origin, is really the product of Christianity. This part of his work, indeed, is vitiated throughout by the fallacy known to logicians as *post hoc, ergo propter hoc*, a very serious fault in the treatment of social questions.

In considering the social and political problems of the present day, Dr. Hill takes the same ground that other Christian teachers do, and we cannot see that he advances any thing new. In regard to the distribution of wealth, he admits that Christianity has no means of solving the problem; and the only suggestion he has to